Robert M. Zwaska

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Employment and Education:

Peoples Fellow (Associate Scientist) – Accelerator Science, Fermilab (2005-Present)
Accelerator Physics Center, Experimental Beam Physics Department

Ph.D. – Particle Physics, The University of Texas at Austin (1999-2005)
Thesis: *Accelerator Systems and Instrumentation for the NuMI Neutrino Beam*
Advisor: Professor Sacha Kopp

B.S. – Physics and Mathematics, University of Notre Dame (1995-1999)

Current Research at Fermilab:

Long Baseline Neutrino Experiment (LBNE)

- I serve as Level 4 manager within the project responsible for targetry. In this position I coordinate high-power target R&D, as well as the production of actual targets and the instrumentation to monitor its properties and integrity.
- I have convened the Beam Simulations Working Group, which is responsible for assembling Monte Carlo codes to simulate the production of secondary particles from the target and, propagation through the secondary optics and decay volume, and ultimate neutrino production.

Accelerator and Neutrino Upgrades (ANU) for the NOvA Project

- I was part of the team that defined and planned the accelerator portion of the project. As part of that work, I managed the beam physics Level 3 group that studied using slip stacking in the Recycler to increase proton power to NuMI to 700 kW, with emphasis on managing the beam loss from the process.
- I am involved with coordinating some of the instrumentation upgrades for higher power, particularly the Hadron Monitor at 700 kW.

Electron Cloud

I have initiated a research program into the electron cloud for the existing and proposed Fermilab accelerators. The electron cloud is a build up of free, non-relativistic electrons in the vacuum of positive-particle accelerators; the electron cloud can have various deleterious effects on the beam.

- Started by installing a simple electron detector in the Main Injector that operated continuously and has no effect on the beam. This detector established the formation of the electron cloud within the Main Injector and the fact that the stainless vacuum vessel surface conditioned with beam exposure.
- I convened the Electron Cloud Working Group within Fermilab that brought together people to do experimental and simulation work on the electron cloud. This group additionally coordinated collaboration with other labs (Cornell, LBL, SLAC, KEK, CERN) on this issue.
- I, with others from the working group, implemented several stations in the Main Injector for the measurement of the Electron Cloud with microwaves.
- Installed a series of test chambers with coatings of TiN and amorphous carbon that could be compared to bare stainless steel for the electron cloud growth. We validated TiN as a good mitigation, amorphous carbon as well – as long as it is treated gingerly, and have plans for other coatings.

MINOS experiment

I participate part-time to ensure that the ultimate scientific goals are realized from my primary accelerator efforts.

- Responsible (with others) for the operation of the NuMI beam monitoring system.
- Take part in the operation and tuning of the NuMI beamline.
- Take shifts to operate the experiment.
- Participate in the review of operations and analyses.
- Write and review publications.
- Served as experimental Run Coordinator

Previous Research:

University of Texas at Austin (2000-5)
NuMI/MINOS (Neutrinos at the Main Injector / Main Injector Neutrino Oscillation Search).

- Performed R&D, constructed, installed, and commissioned the NuMI beam monitoring system (ion chamber detectors). Also used the system for beam-based alignment of NuMI beamline components.
- Performed design work, beam experimentation, and commissioning of an RF feedback system to synchronize the proton beams in the Fermilab Booster and Main Injector. This process, known as cogging, is required to perform the multiple-batch injections necessary for producing a high-intensity beams.
- Commissioned foil SEM profile monitors for high-intensity proton beams, and performed beam experiments with them.
- Simulated neutrino beam fluxes for the NuMI beam, studying variations of beam parameters and the effects of hadron production models. Used the GEANT and FLUKA codes.
- Performed R&D for the NuMI Hadronic Hose, a unique focusing element for neutrino beams (ultimately not implemented).

Leadership, Service, Education, and Outreach:

- Lee Teng Internship selection committee (2011-present)
- URA Thesis award selection committee (2011-present)
- PAC Organizing Committee (2011-present)
- Elected to the MINOS experiment's Executive Committee as representative of the younger collaborators. (2007)
- Run Coordinator for the MINOS experiment (2008-2009)
- Give tours of the NuMI/MINOS underground areas to educational groups (2004-present)
- Give talks and answer questions for the Fermilab Ask-A-Scientist program (2010-present)
- Served as paper reviewer/editor for MINOS publications (2007-present)
- Supervised five undergraduate students for a total of seven summer projects as parts of intern and education programs at Fermilab.
- Supervise a Masters student under the USPAS program for electron cloud research.
- *American Physical Society* member since 2001. Belong to the Division of Physics of Beams, Division of Particles and Fields, Forum on Physics & Society, and Forum on the History of Physics. Secretary (since 2008) and founding member of the Prairie Section.
- *IEEE* member since 2005. Belong to the Nuclear and Plasma Sciences Society (NPSS). Elected in to the Administrative Committee (AdCom) of NPSS representing Particle Accelerator Science and Technology (2011).
- *American Association of Physics Teachers* member since 2005.

Selected Publications:

"The ecloud measurement setup in the Main Injector" ECLOUD10. FERMILAB-CONF-10-508-AD.
"Electron Cloud at Low Emittance in CesrTA" IPAC10-TUYMH02.
"The Conversion and Operation of the Cornell Electron Storage Ring as a Test Accelerator (CesrTA) for Damping Rings Research and Development" PAC09 paper, FR1RAI02.
"Measurement of Electron Cloud Development in the Fermilab Main Injector Using Microwave Transmission" PAC09, FERMILAB-CONF-09-168-AD
"First Measurement of nu(mu) and nu(e) Events in an Off-Axis Horn-Focused Neutrino Beam", PRL **102** 211801. 2009.
"Study of muon neutrino disappearance using the Fermilab Main Injector neutrino beam" PRD **77** 072002. 2007.
"Observation of Muon Neutrino Disappearance with the MINOS Detectors in the NuMI Neutrino Beam", PRL, **97**, 191801. 2006.
"Beam-Based Alignment of the NuMI Target Station Components at FNAL", *Nuclear Instruments and Methods A*, **568,** pp. 548-60. 2006.
"Secondary beam monitors for the NuMI facility at FNAL", *Nuclear Instruments and Methods A*, **568**, pp. 503-19. 2006.
"The Hadronic Hose: Continuous Toroidal Focusing for Conventional Neutrino Beams", *Nuclear Instruments and Methods A*, **498**, pp. 29-5. 2003.

Most all other publications can be found on SPIRES or JaCoW.

I have given over 20 invited talks to conferences and seminars on his research, as well as numerous other contributed presentations and posters.